Alpha Scan Speed Confirmation Rework Data Package Summary for Buildings 271 and 406 at the Former Hunters Point Naval Shipyard, San Francisco, California

Enclosed are the results of the rescanning activities at Buildings 271 and 406 at former Hunters Point Naval Shipyard (HPNS) in San Francisco, California performed in July and August 2016.

Background/MARSSIM Survey Process

Radiological surveys are designed using Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) methodologies to ensure that sufficient, technically defensible data are collected to support the radiological unrestricted release of building surfaces. The process includes scan surveys that are performed to ensure that small areas of elevated concentrations are not present between the systematic sample locations. Biased static and swipe measurements are taken at areas identified above the investigation level during the scan surveys. Systematic measurements are then collected in a triangular grid pattern with a random starting point across a Survey Unit (SU) to identify the net surface concentration at those points. The results of these static measurements are used to perform risk and dose assessments to support free release. Additionally, swipe samples are obtained and analyzed in the same locations to test for removable surface activity.

During the process of surveying the buildings in Parcels B, C, G and E, if radiological contamination was identified above the release criteria, remediation was performed, and the survey process described above was performed in an iterative manner until the data demonstrated that no elevated surface concentrations remained, thereby, ensuring each SU's risk and dose assessments met the criteria for radiological unrestricted release.

All final status survey static measurement results, presented in the Final Status Survey (FSS) Reports for each building, were below the release criterion, and risk and dose modeling for all buildings supported free release. The instrumentation and procedures used for all static measurements followed the protocols and specifications described in the approved survey project plans.

Tetra Tech EC (TtEC) self-reported a variance from the survey protocols for scan surveys, specifically scan speed, and provided several lines of evidence in the *Final Addendum to the Parcels B and G Radiological Remedial Action Completion Reports* (henceforth referred to as RACR Addendum) that demonstrate the survey results remain technically defensible and contain an adequate amount of data of sufficient quality, to support radiological unrestricted release. The RACR Addendum focused on historical building scans performed in buildings in Parcel B and G, but the lines of evidence are applicable to buildings in Parcels C and E.

Building 271 and 406 Survey Process

After concurring with the RACR Addendum, the California Department of Public Health (CDPH) reviewed the pertinent historical information and assessed the buildings in Parcels C and E. The CDPH review, provided on May 17, 2016, recommended resurveying 100% of all Class 1 SUs of Building 271 in Parcel C and 10% of Class 1 SUs and the entire SU 21 of Building 406. The CDPH review stated that the number of SUs could be reduced in Building

271 if it could be identified where remediation was performed in the 2002 Phase V investigation. After further discussion, CDPH and the Navy agreed to re-survey four SUs in Building 271 (SUs 7 through 10) and four SUs in Building 406 (SUs 14, 15, 21, and 22).

Building 271 was selected because it was designated as having "likely" or "known" radiological contamination in the Historical Radiological Assessment report. SUs 7 through 10 were selected because an inspection of the building indicated that the two previously remediated areas were located in SUs 8 and 9 and SUs 7 and 10 were directly adjacent and encompass the ingress/egress route.

Building 406 was chosen due to known radiological contamination that had been remediated. SU 21 was specified by CDPH because remediation was performed in this SU; SU 14 was selected because it is adjacent to SU 21; and SUs 15 and 22 were selected because it was suspected that LLRW bins were stored in these SUs.

The plans for the re-survey process at Buildings 271 and 406 were describe in the document titled *Process for Alpha Scan Speed Confirmation Rework at the Former Hunters Point Naval Shipyard, San Francisco, California* (Attachment 1), which was reviewed by CDPH and DTSC prior to fieldwork.

The scans were re-performed in accordance with the *Base-wide Radiological Work Plan, Revision 1* (TtEC 2007), the building-specific TSPs (*Final Task-Specific Plan for the Building 406 Final Status Survey* [TtEC 2010] and the *Final Task-Specific Plan for the Building 271 Scoping Survey* [TtEC 2011]), and the *Process for Alpha Scan Speed Confirmation Rework at the Former Hunters Point Naval Shipyard* (TtEC 2016). The original scan speeds prescribed in the individual TSPs were used to perform the scans. As a result, the alpha/beta surveys did not exceed the maximum scan speed of 1.37 centimeters per second (cm/s) in Buildings 271 and 406, as specified in the Work Plan and TSPs.

As described in the TSPs, a Ludlum Model 43-37-1 gas proportional detector was used for the alpha/beta scans, and a Ludlum Model 43-68 was used for collecting alpha/beta static measurements. Both detectors were used with the Ludlum Model 2360 ratemeter/scaler data logger operating in the scaler mode. For the alpha and beta scans, the survey detector system recorded the number of counts during the scan time interval (12 seconds). The alpha/beta scan detector system included a laptop that logged the data, performed real-time interpretation of the data, and communicated the results and instructions to the technician performing the survey.

The alpha/beta scans were conducted using a start-and-stop movement. The detector was moved into position by the operator and a 12-second count was started. At the end of the count, the detector was moved one probe width into the next position, where the next count was started. This process ensured that the detector was always moved the same distance over the same interval, and, therefore, ensured that a constant scan speed of 1.33 cm/s was maintained.

If two or more counts were recorded during the counting interval, the computer software stopped the recording process and instructed the operator to pause in this location for a second reading. The operator ensured that the meter was not moved, and then indicated to the computer that the

meter was ready to perform the pause reading. If two or more counts were observed during the 12-second pause, the computer instructed the operator to mark the area for further investigation. The investigation location was marked in the computer software, and, in addition, the operator physically marked the location so that it could be easily identified. The operator also had the ability to add pertinent comments to the program as the survey progressed, but did not have the ability to alter any data. The computer recorded all counts, pauses, and associated comments. This process was followed until the scan survey was completed.

After the scan survey was completed, any areas that were identified as needing further investigation (survey locations resulting in ≥ 2 alpha counts) were assessed by collecting biased static measurements. The biased static readings were collected by taking a 2-minute scalar count utilizing a Ludlum 2360 coupled to a Ludlum 43-68 detector.

The alpha/beta scans were conducted using strict quality controls regarding the scan speed, which was continuously monitored, recorded, and verified. In addition, the Navy's radiological quality control contractor performed additional independent quality assurance checks throughout the survey process.

Building 271 and 406 Survey Results

Scanning survey activities began on July 28, 2016 and were concluded on August 19, 2016. A total of 6,888 individual scan readings were collected on the floors and walls of SUs 7 through 10 in Building 271. Based on the results of the scans, 276 locations were identified for further investigation. A total of 6,559 individual scanning readings were collected on the floors and walls of Building 406 in SUs 14, 15, 21, and 22. Based on the results of the scans, 319 locations were identified for further investigation.

TtEC took static measurements at all of the areas identified above the investigation level. In Building 271, three of the 276 locations had alpha and/or beta measurements above the release criteria. Two of these locations were located in SU 7 and one was located in SU 9. In Building 406, five of the 319 locations had alpha and/or beta measurements above the release criteria. All five of these locations were located in SU 21.

The degree to which any single localized area between static measurement locations can be elevated above release criteria and have no impact on the resulting dose is defined by the Area Factor multiplied by the release criteria (TtEC 2010). Based on modeling of the systematic static data for each survey unit, the Area Factors for SUs 7 and 9 in Building 271 were calculated to be 11.90 and 35.49 respectively. The area factor for SU 21 in Building 406 was calculated to be 11.89. None of the elevated alpha or beta measurements were above the respective Area Factors multiplied by the release criteria.

To ensure that the elevated locations do not pose a risk to human health and the environment, TtEC did some follow-up evaluation on the locations. Using a Ludlum Model 43-68, the sizes of the elevated surface areas were found to be less than 100 cm^2. Alpha and beta swipe measurements were taken at each of the locations to ensure there was no removable activity. All swipe measurements were below the release criteria.

Residual Radioactivity in Buildings (RESRAD-BUILD), Version 3.5 was used to calculate the dose and risk from the small areas of elevated radioactivity. The calculated dose from the maximum alpha surface measurement (1,068 dpm/100 cm^2 in SU 21 of Building 406) is 2.55×10^{-4} mrem/y. This dose is equivalent to an elevated lifetime morbidity rate (ELCR) of 6.4×10^{-9}. The calculated dose from the maximum beta surface measurement (8,871 dpm/100 cm^2 in SU 7 of Building 271) is 3.67×10^{-3} mrem/y. This dose is equivalent to an ELCR of 9.2×10^{-8}. Both doses are below the U. S. Environmental Protection Agency (EPA) established risk management dose of 12 mrem/y or an ELCR of 3×10^{-4} (EPA 2014).

Tables 1 and 2 show a summary of the static, scan, and swipe survey measurements and resulting dose for each survey unit in Buildings 271 and 406. Data packages including SU figures and survey results are provided in Attachment 2 and RESRAD-BUILD reports are provided in Attachment 3.

Conclusion

The maximum mean alpha surface concentration of 21 dpm/100 cm^2, identified in Building 406 in SU 21, is significantly less than the release criterion of 100 dpm/100 cm^2. In addition, the maximum mean beta surface concentration of 137 dpm/100 cm^2, identified in Building 271 in SU 7, is significantly less than the release criterion of 1,000 dpm/100 cm^2. The removable alpha and beta surface concentrations are significantly less than their release criteria. The summary statistics including the dose and risk of the mean alpha and beta systematic surface concentrations for Buildings 271 and 406 are included in Tables 1 and 2, respectively. The maximum dose and risk are 0.087 mrem/y with an ELCR of 9.98×10^{-8} identified in Building 406 in SU 21. The doses and risks from the residual radioactivity in Buildings 271 and 406 are orders of magnitude less than the release criteria listed in the TSPs.

The rescanning at Buildings 271 and 406 confirmed that the conclusions presented in the previous FSS reports remain valid and the radiological RAOs for Parcel C and E have been met.

- Results show that each SU meets the release criteria based on the average measured alpha and beta activity.
- Small areas of contamination above the release criteria were identified; however, these areas did not impact the resulting dose for the SUs.
- Risk and dose modeling show that radiation activities meet federal release criteria and pose no significant increase in dose or risk above background radiation levels.
- Swipe measurements were below the release criteria confirming that contamination identified was not removable.

While, the radiological scanning and static surveys and removable surface concentration measurements described in this report demonstrate through multiple lines of evidence that Buildings 271 and 406 meet the release criteria and are safe for human health and the environment, the Navy has decided to remediate the three locations in Building 271 and the five locations in Building 406 where elevated surface contamination was identified. The Navy has decided to remediate these areas to be consistent with Navy policy to remediate known contamination out of an abundance of caution and to be consistent with past work conducted at HPNS. However, the Navy maintains that given the small area of known contamination, less than 100 cm^2, and the lack of significant human health risk, an ELCR less than 3×10^{-4} additional remediation at Buildings 271 and 406 is not necessary to protect human health and the environment.

TABLE 1

SUMMARY OF STATIC, SCAN, AND SWIPE SURVEY MEASUREMENTS IN BUILDING 271

SU	Area (m^2)	No. of Static Measurements	Alpha Static Mean[a]	Alpha Static Maximum[a]	Beta Static Mean[a]	Beta Static Maximum[a]	No. of Scans	Alpha Scan Mean[a]	Alpha Scan Maximum[a]	Beta Scan Mean[a]	Beta Scan Maximum[a]	Alpha Swipe Mean[a]	Beta Swipe Mean[a]	Dose (mrem/y)[b]	ELCR[b]
7	71.9	60	3	134	137	8,871	1,719	-2.59	39.2	129	1,198	1.32	11.5	0.031	1.95E-08
8	83.8	99	1	31	-171	348	1,996	-2.59	30.8	31	568	NA	NA	0.001	6.92E-10
9	62.2	28	10	259	-153	694	1,410	-1.59	48.5	42	803	1.32	-34.4	0.002	1.22E-09
10	88.7	89	0	19	-347	96	1,763	-2.59	39.2	-124	409	NA	NA		

Notes:

[a] surface concentration units are in dpm/100 cm^2

[b]. The dose and ELCR are calculated using the systematic static survey measurements and RESRAD-BUILD

Shaded portions of the table indicate that the residual dose was determined to be 0.00 mrem/y, with no additional increase in ELCR, due to the net mean concentration of both alpha and beta being less than zero for the survey unit.

Abbreviations and Acronyms:

cm^2 – square centimeter
dpm – disintegrations per minute
ELCR – excess lifetime cancer risk
m^2 – square meter
mrem/y – millirem per year
NA – not applicable (swipes were not required)
SU – Survey Unit

TABLE 2

SUMMARY OF STATIC, SCAN, AND SWIPE SURVEY MEASUREMENTS IN BUILDING 406

SU	Area (m^2)	No. of Static Measurements	Alpha Static Mean[a]	Alpha Static Maximum[a]	Beta Static Mean[a]	Beta Static Maximum[a]	No. of Scan Measurements	Alpha Scan Mean[a]	Alpha Scan Maximum[a]	Beta Scan Mean[a]	Beta Scan Maximum[a]	Alpha Swipe Mean[a]	Beta Swipe Mean[a]	Dose (mrem/y)[b]	ELCR[b]
14	94.5	81	5	44	-163	347	1,704	2.67	44.4	68	587	NA	NA	0.056	5.98E-08
15	97.1	36	-9	19	98	304	1,514	-2.59	30.8	57	1,278	NA	NA	0.066	7.59E-08
21	94.5	161	21	1,068	-126	2,706	1,656	-1.51	115.4	114	550	3.22	-0.43	0.087	9.98E-08
22	97.1	41	-6	19	64	670	1,685	-1.59	38.2	142	806	NA	NA	0.069	6.74E-08

Notes:

[a] surface concentration units are in dpm/100 cm^2

[b] The dose and ELCR are calculated using the systematic static survey measurements and RESRAD-BUILD

Abbreviations and Acronyms:

cm^2 – square centimeter
dpm – disintegrations per minute
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m^2 – square meter
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SU – Survey Unit